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A Study on Inventorship in Japan and its Application to AI-related Inventions*

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I. Introduction

Rapid advances in Artificial Intelligence (AI) technology are bringing about big changes in our lives. In Japan, "Society 5.0" was proposed in the 5th science and technology basic plan (2018).[1)] Society 5.0 is a concept of a new human-centered future society realized by incorporating innovative technologies, such as AI, Internet of things (IoT), robots, and big data, into all industries and societies. In the current information society, value has been created by human beings accessing and analyzing information. Society 5.0 is a system that highly integrates cyberspace (virtual space) and physical space (real space). AI analyzes huge amounts of big data beyond human capabilities, and the optimized results are fed back to humans through robots and other devices. This process brings a new value to industry and society that was not previously possible. AI and big data analytics will be key technologies. In other words, the appropriate protection of rights is required. Will AI stay as a tool in the future when big data is used more and more in every part of society, or will it be recognized as an entity to be invented?

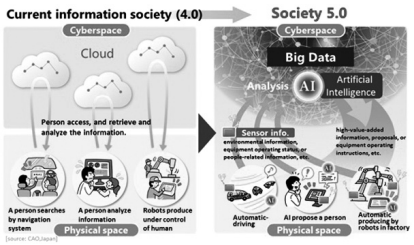

Fig. 1 : "How Society 5.0 Work" (Cabinet office)

Furthermore, new issues have been raised in the AI field, which concern the present patent system. For example, the invention by AI/DABUS, which was filed last year, has received a great deal of attention. International organizations, such as

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1) Cabinet Office, https://www8.cao.go.jp/cstp/english/society5_0/index.html (accessed Nov. 1, 2020).

the World Intellectual Property Organization (WIPO), are cautiously debating whether to identify AI as an inventor. On the other hand, regarding the recognition of the inventor, it seems that there is not much discussion about the fact that recognition standards differ depending on the country where the invention took place. In this situation, the internationalization of Research and Development activities and the spread of open innovation have accelerated technological innovation. As the opportunities for collaborative research by multiple researchers from different countries and affiliations increase, an original inventor or a joint inventor can become a problem. In that case, the relationship between the inventors, the right holder, and the third party is complicated. Who the "true inventor" is an important issue, but since it is an issue in the process of creating an invention, it is often difficult to determine who qualifies as an inventor and joint inventor.

In this paper, we will sort out the traditional inventorship standard based on the current rules and judicial precedents in Japan and examine the necessary standards for inventorship about AI-related inventions at the present stage.

II. Structure of the patent system in Japan

A patent right is granted to a person who discloses an invention, and the patentee can exclusively implement the invention for a certain period. Needless to say, to grant a patent, the invention must meet certain requirements, but the inventor who is the subject of rights must also be a "true inventor." An application by a person unrelated to the invention (a person who does not have the right to obtain a patent) or a person who has not succeeded to the right to obtain a patent for the invention is a usurped application and a reason for rejection (Art. 49(vii)). When a patent is granted under these circumstances, there is a ground for invalidation (Art. 123(1)(vi)). When an invention is jointly created, the right to obtain a patent is shared and must be filed by all the inventors. A violation of this rule is a reason for rejection (Article 49, (2)) as a joint application violation (Article 38), and if it is patented, it is a reason for invalidation. In Japan, if the right to obtain a patent or the patent right is shared, the application, transfer of equity, or license cannot be made without the consent of all the co-owners. Furthermore, while the application is pending at the Japan Patent Office (JPO), amendments such as addition or deletion of an inventor are possible, but after registration of the patent right, the addition or deletion of the inventor is impossible regardless of inadvertent error or misrepresentation.

(1) The criteria of inventorship and joint inventorship

The Japanese Patent Act does not have a clear provision for the inventor.[2] However, it is possible to understand the requirements from the accumulation of judicial precedents. An inventor is thought to be a person who was actually involved in the highly advanced creation of technical ideas utilizing the laws of nature for the invention. There is no dispute that the inventor is understood to be the one who is mentioned above[3]. The court also determined that the following cannot be deemed to have been actually involved in the creation of technical ideas and should therefore be excluded from the scope of joint inventors: (i) a person who has merely provided general management for the inventor (mere manager), for example, merely given the inventor general research themes without a specific concept, general guidance in the course of the creation of the invention, or abstract advice for the solution to the problem; (ii) a person who has merely followed the inventor's instructions or assisted the inventor (mere assistant), for example, merely compiled data, prepared documents, or conducted experiments; (iii) a person who has merely supported the inventor in completing the invention (mere supporter), for example, provided the inventor with funds or allowed the inventor to use their equipment.[4] Therefore, in Japan, the substantial value of an invention lies in a new solution to a technical problem, and the true inventor needs to be actually involved in the solution to a technical problem in the scope of claims. Regarding the degree of creation of technical ideas, that is, the completion of inventions, the Supreme Court stated as follows. "It must be structured as concrete and objective to the extent that a person ordinarily skilled in the art in the relevant technical field can repeatedly carry out and achieve the desired technical effect."[5] This is called the concept of completion of the invention and is cited in many subsequent judicial precedents. The application form must state the "inventor's name" and "patent applicant's name or company name." An inventor is a natural person with a name, whereas the patent applicant is considered to include not only a natural person but also a corporation.

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2) Japan Patent Act Article 29(1) "An inventor of an invention that is industrially applicable may be entitled to obtain a patent for the said invention, except for the following".
Intellectual Property Basic Act Art. 2(1)"The term "intellectual property" as used in this Act shall mean inventions, devices, new varieties of plants, designs, works and other property that is produced through creative activities by human beings…".

3) Nobuhiro Nakayama, *Tokkyo Hou (Patent law)[4$_{th}$ ed]*, p.45 (Koubundou 2019).

4) Tokyo District Court of September 13, 2005. Hanrei jiho No. 1916, p.133.

5) Supreme Court of October 13, 1977, Minshu Vol.31, No.6, p. 805.

There were interesting cases about the invention of Nobel laureate Professor Honjo in Japan and the United States this summer. The content of this proceeding is a joint inventorship dispute over groundbreaking work in the field of cancer treatment. Each patent at issue claims a method of treating cancer by administering antibodies targeting specific receptors on T cells. The plaintiffs for each in the United States and Japan are unrelated cases, but they were involved in this patented invention during the research period.

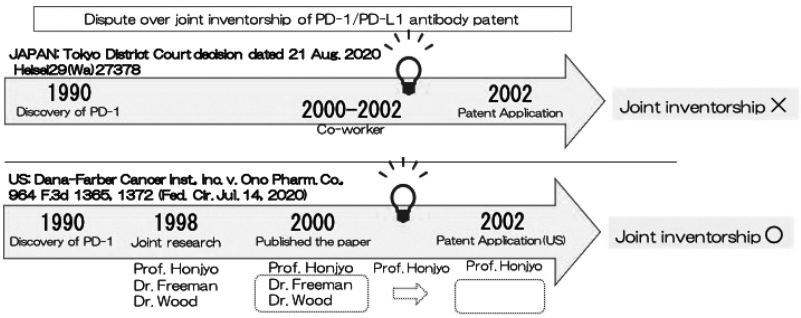

Fig. 2 : Dispute over joint inventorship of PD-1/PD-L1

In the case of Japan,[6] The plaintiff, who was a graduate student between 2000 and 2002, sought the status of a co-inventor. The Tokyo District Court considered the following requirements for joint-inventorship: 1) contribution to the realization of "preparation and selection of anti-PD-L1 antibody that inhibits the interaction between PD-1 molecule and PD-L1 molecule," 2) degree of creative involvement in terms of "contribution in design and construction of experimental system and execution process of individual experiment required for proof of hypothesis." The judge admitted that the plaintiff had made a certain contribution, but the degree of contribution was minimal, and he was not recognized as a co-inventor.

In the US case,[7] researchers who had been conducting joint research before the conception of the patented invention sought joint inventorship. The CAFC considered the contributions to the research (identifying the PD-1 ligand, the discovery of inhibited the immune response, etc.) conducted two years before the conception and identified two researchers involved as joint inventors. The Federal Circuit Court affirmed the District Court's decision. The court applied inventor

6) Tokyo District Court of August 21, 2020, Heisei 29 (Wa) 27378.

7) Dana-Farber Cancer Inst., Inc. v. Ono Pharm. Co., 964 F.3d 1365 (Fed. Cir. 2020).

standards as follows: "inventors may apply for a patent jointly even though (1) they did not physically work together or at the same time, (2) each did not make the same type or amount of contribution, or (3) each did not make a contribution to the subject matter of every claim of the patent."[8] The court concluded that Ono improperly asked it to adopt an unnecessarily heightened requirement for inventorship. According to the court, joint inventors need not contribute to all aspects of a conception. In addition, the court observed that "joint inventorship does not depend on whether a claimed invention is novel or nonobvious over a particular researcher's contribution." The court disagreed that "research made public before the date of conception of a total invention cannot qualify as a significant contribution to conception of the total invention." The court concluded that the publication of a portion of the complex invention did not defeat joint inventorship of that invention.

Considering the Japanese inventor concept, which requires involvement in the characteristic part of the invention, it is in contrast to the US approach, which recognizes the contribution of the act of involvement retroactively from conception. Since the identification of inventorship is a starting point for determining the attribution of an invention, if the criteria are different, the patents granted to the same invention may belong to different entities, resulting in a dispute. It has been pointed out that in the United States, a fundamental review of the law is necessary because it does not match the current situation in which multiple different development entities collaborate.[9] It is necessary to discuss the establishment of international rules that do not require the confirmation of the inventor in each country of application. I would like to carry out this analysis at another time.

(2) Two methods for inventor identification

Looking back at the judicial precedents, there are two ways to identify the "inventor." The first approach has been adopted in a few court decisions. It is a way to make an identification by dividing it into two steps: providing a conception of an invention and reduction to practice (two-step test).[10] 1) The person who provided the conception will be an inventor if the conception is new.[11] 2) If a

8) 35 U.S.C. § 116(a).

9) Lisa Vertinsky, Boundary-Spanning Collaboration and the Limits of Joint Inventorship Doctrine, 55 Houston Law Review 401 (2017).

10) Kosaku Yoshifuji & Kenichi Kumagai, "*Tokkyo Hou Gaisetsu [revised & enlarged 13th ed.]*" (Overview of Patent Law) p.188 (Yuhikaku 1998).

11) Tokyo District Court of April 16, 1979, Hanrei Times, No.395 p.155 [The Grain Processing↗

person reduced a new conception to practice, he/she will be a co-inventor as long as this reduction to practice would not be obvious to a person skilled in the art.[12] The co-inventor determines that the creation of a technical idea is not just a conception but that the conception needs to be materialized. In a recent court case, even if the person did not complete the invention, the person who discovered the technical significance of the invention was recognized as a co-inventor.[13] In this approach, the time the invention is completed is determined, the parties involved before and after the completion are distinguished, and the persons involved in the final process are specifically identified as inventors.[14]

The second approach is, first, to identify a characteristic part of the invention (a part that is not found in the prior art, in other words, a part that is fundamental to problem solving and is specific to the invention)[15]. Then, identify 1) the person who presented the problem to be solved, 2) the person who devised the means for solving the problem, and 3) the person who confirmed that the problem was solved by the means. Finally, from among persons 1) to 3), identify the "inventor," that is, the person who made a substantive or important contribution, or a contribution that would not be obvious to a person skilled in the art, in the process of creating the technical idea. In many cases, an important contribution is made by person 2). This test was established by a Supreme Court decision[16] and has been adopted in many subsequent decisions by lower courts.

There are two approaches in this way: the former is to identify the conception in two steps, and the latter is to first determine the characteristic part of the invention. The purpose remains to determine whether the person is actually involved in the creation of the technical idea of the invention, that is, the solution to the problem of the invention. Besides, these two approaches are not clearly distinguished in the court decisions mentioned above, but this is simply a possible way to sort out the approaches adopted in court decisions. The important point is

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↘Method case].

12) Tokyo High Court of April 27, 1976, Torikeshishu 1976, p.449.

13) IP High Court of 24 June 2015, Hanrei jiho No.2274, p.103[Bagged antibacterial agent case].

14) Yoshiyuki Tamura “Identification of Inventorship- Merits and demerits of the method of distinguishing "characteristic parts" and the concept of invention completion” L&T additional volume, No.2, p.53(2016).

15) Nobuhiro Nakayama-Naoki Koizumi, “*Shin-tyuukai Tokkyo Hou (2nd ed)*”, p.386 (Seirinshoin 2017).

16) Supreme Court of October 13, 1977, Minshu Vol.31, No.6, p.805 and October 13, 1986, Minshu Vol.40, No.6, p.1068.

how to find a characteristic of the technical idea of the invention. On the other hand, there are also judicial precedents that consider the technical field, particularly in the chemical field where it is often not clear, without an experiment, whether a specific constitution produces the desired effect. In to a decision,[17] the court denied inventorship due to the absence of practical contribution on the part of the plaintiff, holding, "In the chemical field, when a particular phenomenon is observed, this does not necessarily mean that the technical idea is concrete/objective enough to be put into practice by the person skilled in the art. There may be a need for research to verify its reproducibility, efficacy etc." In the mechanical field, it is often the case that the results embodied at the conception stage can be predicted. However, the technology is diverse and its nature may not always apply. Based on the understanding that there is such a tendency, each invention should be decided in light of what its technical idea is.

III. Patent application by AI DABUS

In the research and development stage so far, computers have played a role as simply a tool for discovering new materials, extracting drug candidate compounds, and assisting inventors. An artificial intelligence project team led by Professor Abbott of the University of Surrey filed an application to raise questions about the existing patent system in 2019[18]. DABUS is an AI developed by Dr Stephen Thaler that can create ideas without human intervention. There are two inventions, the one is food container and the other is a flashing light for use in emergencies were filed. According to the lawyers involved in the patent application, Dr. Thaler spent 10 years developing DABUS, only entering data related to the fields. Both are inventions outside the expertise of Dr Thaler. He is not giving instructions for the invention, so he is not the inventor. Professor Abbott and colleagues point out that some software and algorithms can be regarded as acts similar to inventing[19].

The invention devised by AI DABUS was filed in the United States, the European Patent Office (EPO), the United Kingdom, and Israel, with DABUS as the inventor. In August 2019, the United States Patent and Trademark Office (USPTO) said that patent applications could not be considered unless all inventors

17) IP High Court of May 29, 2008, Hanrei Jihou No.2018, p.146.

18) The Artificial Inventor Project, https://artificialinventor.com/ (accessed Nov.1, 2020).

19) See Ryan Abbott, Artificial intelligence, big data and intellectual property: protecting computer generated works in the United Kingdom, *Research Handbook on Intellectual Property and Digital Technologies* (edited by Tanya Aplin, p.323 (Elgar 2020).

were registered by name. The European Patent Convention (EPC)[20] and the UK Patent Law[21] also provide for the name of the inventor. In January 2020, the EPO and the UK Intellectual Property Office (UKIPO) each rejected patent applications that designated DABUS as an inventor. In decisions shown in 2019 and 2020, the primary reason for these outcomes concerned the fact that DABUS was a machine. The legal frameworks applied by the EPO, UKIPO, and USPTO require the inventor to be a natural person.

The problem here is the concern that the inventors of these AI-related inventions will be absent. It is considered necessary to adjust the interests of rights entities and trading activities that assume a "human-centered" social infrastructure.

IV. Analysis

AI can memorize huge amounts of information; however, it does not work based on meaning. As long as humans who use AI play a major role in inventing, it is unlikely that AI will be identified as an inventor. In the future, with Society 5. 0 realized, AI will analyze big data and give feedback the best way to humans. However, It is necessary to adjust the interests of the rights entity and transaction activities in preparation for expanding the use of AI in the future. Therefore, it will be time to reconsider the standards for the invention of the new world.

Here, we consider inventorship using a hypothetical case. In connection with a hypothetical patentable invention made using AI, we consider co-inventorship by one or more human contributors[22].

(1) *Using AI to design a particular type of product or process when the resulting patentable invention is of the type of product or process intended.*

As a premise, as an inventorship requirement in Japan, it must be a person

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20) EPC Rule 19(1) : “The designation shall state the family name, given names and full address of the inventor….”

21) UK Patent Act 2004 section13: “(1) The inventor or joint inventors of an invention shall have a right to be mentioned as such in any patent granted for the invention and shall also have a right to be so mentioned if possible in any published application for a patent for the invention and, if not so mentioned, a right to be so mentioned in accordance with rules in a prescribed document.”

22) I appreciate the insightful comments and feedback offered by AIPPI-JAPAN Patent committee (Kay Konishi, Hideki Takaishi, Etsuko Yoshida, Nobuyuki Taniguchi, Nobushige Furuhashi, Tamaki Horikawa, Masaya Tsuno), AIPPI Study Committees "Inventorship of inventions made using Artificial Intelligence" Japan National Group Report <https://aippi.soutron.net/Portal/DownloadImageFile.ashx?objectId=8418> (accessed Nov.1, 2020).

who "made a creative contribution to the completion of a characteristic part of an invention, in the process of conception and reduction to practice, in order to solve a problem." In this case, it is clear that the person who used AI with the intention of the result contributed creatively to the completion of the characteristic part of the invention by using AI as a tool in the process of conception and its realization.

(2) ***Using AI to achieve a specific purpose intended, the resulting patentable invention was not directly related to the intended purpose.***

It is considered that it is the user of AI who has found a useful relationship leading to a patentable invention. The user of AI corresponds to a person who "creatively contributed to the completion of the characteristic part of the invention in the process of the conception for solving the problem and its reduction to practice." For instance, in the pharmaceutical field, an originally expected outcome is not always the same as an outcome that will be supported by reviewing the results of a specific experiment. Therefore, it is considered that the difference between the actual result and the one originally intended does not affect the recognition of the inventor.

(3) ***Designing or contributing to the design of the AI algorithm that is used in (1) or (2)***

In the case of (1), if the AI algorithm is simply general-purpose, it is not aimed at solving a specific problem and does not contribute to the completion of the characteristic part of the invention. In other words, it may not be regarded as an inventor because it does not fall under the act of "creatively contributed to the completion of the characteristic part of the invention in the process of the conception for solving the problem and its reduction to practice." However, if the general-purpose algorithm has been specially customized to solve a particular problem, or if it is an algorithm specifically devised for patenting a particular type of product or method, the person who made the above is an inventor because it contributes to the completion of the characteristic part of the invention in the process of the conception for solving the problem and its reduction to practice.

In the case of (2), if the result is a patentable invention that is not directly related to the problem-solving aimed at by the AI algorithm, then it would not be considered an inventor in such cases. This is because the AI algorithm has not contributed to the completion of the characteristic part of the invention in the process of the concept for solving the problem and its implementation.

(4) ***Selecting the data or data source to train the AI algorithm used in 1) or 2)***

In the case of (1), choosing the right data or data source for the design of a particular type of product or method to train an AI algorithm produces a trained AI algorithm aimed at solving a particular problem. The choice of data or data source for this purpose is considered to have "creatively contributed to the completion of the characteristic part of the invention in the process of the conception for solving the problem and its reduction to practice."

In the case of (2), if the data or data source suitable for the design of the particular type of product or method selected to train the AI algorithm is different from the intended purpose but patentable, it does not contribute to the discovery of useful relationships. Therefore, it would not be considered the inventor.

(5) ***Selecting/generating the data or data source to enter into the trained AI algorithm used in (1) or (2)***

In such cases, selecting or generating data or data sources to enter into the trained AI algorithm will affect the output of the trained AI algorithm. For the person who selected/generated the data or data sources, whether the data meets the constituent requirements of the claimed invention will be the key to being identified as an inventor. Give that, in the case of 1) is considered to be the inventor, in the case of 2), it is unlikely that it contributed to the characteristic part of the invention, so it would not be considered the inventor.

(6) ***Selecting one from many outputs by AI of (1) or (2) and recognizing it to be a patentable invention.***

If a selection is made from many outputs by AI and it is a patentable invention, it is considered to provide the technical features of the invention. Therefore, it would be considered the inventor.

For DABUS to be identified as an ultimate existence to invent, it is necessary to clarify the contributions involving humans and AI, but the details of the contributions made by DABUS have not been disclosed. According to the Japanese standard way of thinking, the original inventor should contribute to the characteristic part of patented inventions. As mentioned above, an inventor is a person who is directly involved in an invention created by a technical idea. Even if AI is used to create new problem-solving methods, the architecture of AI systems, selected teacher data, designed AI algorithms, have designed by humans. Therefore, it would be considered the use of AI as a means in the present technical stage.

V. Conclusion

There is no doubt that big data is at the core of accelerating digital transformation. However, digital transformation is a tool that makes society more convenient, and human beings should play a role in creating new value in society. It is expected that new business practices and legal systems will be born from this. In a situation where technology advances day by day, much more discussion will be needed. Instead of focusing solely on AI involvement, the requirements for human and AI involvement should first be clarified. Disclosure of contributions to the invention itself will lead to better co-creation activities and it will also be an opportunity to reconsider the status of joint inventions in the digital Era. The patent system should be an accelerator for innovation and not an obstacle to development activities.